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hereby declare that I am conversant with the French and the English languages and I certify that to the best of my knowledge and belief the following is a true and correct English translation of the specification contained in French patent application

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Bituminous upper layer draining blanket

The invention relates to a bituminous upper layer draining blanket, a method of realization of such an upper layer blanket, as well as a carriageway comprising such an upper layer blanket.

The bituminous upper layer draining blanket, subject matter of this invention, is intended for the realization of surface layers of stressed carriageways exposed to:

- wheel rutting,
- pollution,
- high traffic level.

Indeed, an upper layer draining blanket, in its current design, is composed of a layer of granular materials coated with a bituminous binder and applied to the required thickness.

The percentage of voids and the shape of the voids are such that rainwater may circulate in the communicating voids once this layer has been applied.

This layer is usually applied using a hooking layer onto a sub base layer when building a new carriageway or onto a surface layer in the case of maintenance. The hooking layer makes the underlying layer watertight, if the said is not already watertight intrinsically, while ensuring perfect bonding between both layers. This perfect bonding confers on both these layers a behavior that is similar to that of a single layer.

The bituminous draining concrete layers are:

- standardized by the standard NF P 98.134 as having:
  - a voids content in the order of 20%, and
  - a percolation rate measured at the building site drainometer (NF P 98-254-3) greater than 0.4 cm/s and
- characterized in the engineering notices regarding carriageways made of special draining coated materials for company products as having
  - a voids content ranging between 20 and 25%, and

- a percolation rate measured at the building site drainometer (NF P 98-254-3) ranging between 0.8 cm/s and 1.3 cm/s.

Under the effect of the traffic, the drainage function in the bulk of this type of upper layer blanket decreases with time as a function of the ageing of the carriageway, in a variable fashion according to the product. Indeed, surface pollution is caused by rainwater in the bulk of the coated material.

The floating effect, created by the tires, that is added to the gravitational movement of rainwater in the aggregate, repels the various polluting particles only partially.

These polluting particles are deposited, silt up and negate the draining function in the aggregate of these draining coated layers.

Surface drainability, for its own part, remains good.

The purpose of the invention is to remedy the shortcomings mentioned above and to prevent, at least, any deterioration of the draining function in the aggregate. Advantageously, the invention should enable to improve the adherence as well as to reduce the sound nuisances generated by this type of coated materials. This target must be reached under good economic conditions.

The purpose of the invention is satisfied by creating a granular differential and by promoting the horizontal and vertical draining functions in the aggregate of the coated material thanks to a suitable granular structure.

Thus, the invention relates to a bituminous upper layer draining blanket composed of two sections or partial layers, which share the improvement of the specific functions of the new upper layer blanket, i.e. improvement of the surface characteristics and improvement of the drainage and anti-rutting property.

The bituminous upper layer draining blanket comprises two partially superposed layers whereof the upper partial layer contains aggregate with low particle-size distribution and a modified bituminous binder, and whereof the lower partial layer contains aggregate with high particle-size distribution and a bituminous binder.

The partial layers are made of, or treated with, bituminous binders that can be elastomer or not.

The materials and the binders are determined in relation to:

- the type of climate
- the altitude
- the stress level.

The invention also takes into account:

- the risk of wheel rutting,
- the risk of cracking by thermal shock,
- the risk associated with the slow speed of heavy vehicles and their channeled traffic,
- the risks associated with particular zones:
  (small radius curves, braking zones, parking zones, ramps).

The partial layers of the upper layer blanket are formulated so that the resultant upper layer blanket :

- is not, or little, exposed to wheel rutting,
- generates little noise,
- promotes an increased micro-roughness in surface while preserving original macro-roughness of conventional draining coated materials,
- improves significantly by its assembly the lifetime of the draining capacity of the coated materials with time.

To this end, the invention also concerns the characteristics below, considered individually or in all their technically possible combinations:

The aggregate size distribution ratio of both partial layers is approx. 3:1 to 4:1.

The aggregate size distribution of the upper partial layer is selected among the 2/4, 4/6 and 6/10 ranges.

The aggregate size distribution of the lower partial layer is selected among the 10/14, 10/20 and 14/20 ranges.

The aggregate is of mono-granular type without any fines in the upper partial layer.

The aggregate is of mono-granular type without any fines in the lower partial layer.

The term 'mono-granular' signifies the use of a single granular class for the preparation of the material respectively of the upper or lower partial layer.

The voids content of the lower partial layer of the upper layer blanket is equal to or greater than 25%.

The percolation rate measured at the building site drainometer (NF P 98-254-3) on the upper layer blanket is equal to or greater than 3.2 cm/s.

The Hsv roughness of the upper partial layer is equal to or greater than 0.80 mm (NF P 98-216-1).

The sound attenuation of the traffic noise associated with the complex of the upper layer blanket (NF S 31-119) is equal to or greater than 3 dBA.

Either or both of the lower and upper partial layers may comprise mineral or organic additives. These additives may be for instance rock or glass fibers or waste aggregate. They are injected during the manufacture of the material in order to form the corresponding partial layer.

A draining partial upper layer made of coated materials without any sands, with size distribution of for example 2/4 to 4/6 with an elastomer binder and small surface thickness, between 1.5 and 2 cm, enables to:

- ensure the surface characteristics (binding safety);
- reduce the noise level;
- ensure tire/carriageway contact;
- strengthen surface roughness and ensure macro-roughness.

A draining partial lower layer made of coated materials with very high size distribution, for example 10/14 to 14/20 with or without an elastomer binder and a surface thickness between approx. 2.5 and 4 cm, enables to:

- negate the clogging effect of the coated material thanks to its very high drainability, which confers it longer efficiency than the draining coated materials of the standard NFP 98-134 or defined in the engineering notices on company products,
- improve the anti-rutting property of the coated material,
- increase the drainage capacity,
- promote horizontal and vertical circulation of water.

The invention also concerns a draining hot bituminous coated material intended for making up a blanket comprising aggregate and a bituminous binder modified by polymers in the sense of this invention.

Its main advantages are described above.

The bituminous coated material of the invention may exhibit any of the following technical characteristics, individually or in combination:

- the modified bituminous binder is a pure bitumen modified by a styrene-butadiene-styrene (SBS) copolymer,
- the modified bituminous binder may be of different composition according to the partial layer of the blanket,
- the recommended binder content depends on the granular class used, the possible addition of filler and the mineralogical nature of aggregate,
- the aggregate is of mono-granular type without any smalls in the lower partial layer,
- the aggregate is of mono-granular type without any smalls in the upper partial layer,
- the size distribution of the aggregate complies with one of the following ranges:
  - for the upper partial layer 2/4 – 4/6 – 6/10
  - for the lower partial layer 10/14 – 14/20 – 10 – 20;
- filler can be added or not; the addition of filler may prove necessary when manufacturing this coated material, if the content of natural fines of the class(or classes) used is insufficient. The make-up filler is a filler conventionally used in the formulation of coated materials of calcareous nature and is injected according to a percentage of approx. 1 to 5%;
- mineral or organic additives are used.

The application of a hooking and watertight (suited binder and dosage) layer enables to:

- ensure binding with the support of the layer, and
- obtain surface tightness of the former upper layer blanket.

The invention also relates to a carriageway realized with a bituminous upper layer blanket or coated material as defined previously.

The invention also concerns a method of manufacture of an upper layer blanket as defined above, whereas

a) binding both partial layers may be provided by an application machine that lays the blanket in a single pass, and

b) both partial layers may be bonded as well by two passes of the road finishing machine without any chemical binding.

Specific size distribution of the upper partial layer of the blanket ensures mechanic hooking with the lower partial layer by interpenetration of the aggregate elements of the contact surfaces during appropriate compacting.

Each portion of the coated material is compacted by smooth rolling.

The bituminous coated material according to the invention is manufactured in any coating station complying with the production of quality coated materials.

Other characteristics and not limiting advantages of the invention will appear when reading the embodiment hereunder:

- Realization of the coated material for the lower partial layer with:
  - size distribution 10/14 ≥ at 95%
  - addition of filler material through 80 µ mesh sieve ≥ at 2%
  - content of modified binder such as that known under the denomination 'COLFLEX' ≥ 3 ppc.
- Realization of the coated material for the upper partial layer with:
  - size distribution 4/6 ≥ at 95%
  - addition of filler material through 80 µ mesh sieve ≥ at 2%
  - content of modified binder such as that known under the denomination 'COLFLEX' ≥ 4 ppc.

The temperature of realization and of application remains similar to that of the monolithic draining coated materials with elastomer binders. It is equal to or greater than 135°C.

CLAIMS

1. A bituminous upper layer draining blanket, characterized in that it comprises two partially superposed layers whereof the upper layer contains aggregate with low particle-size distribution and a modified bituminous binder, and whereof the lower layer contains aggregate with high particle-size distribution and a bituminous binder.

2. A layer according to claim 1, characterized in that the aggregate size distribution ratio of both partial layers is approx. 3:1 to 4:1.

3. A layer according to claim 1 or 2, characterized in that the aggregate size distribution of the upper partial layer is selected among the 2/4, 4/6 and 6/10 ranges.

4. A layer according to one of the claims 1 to 3, characterized in that the aggregate size distribution of the lower partial layer is selected among the 10/14, 10/20 and 14/20 ranges.

5. A layer according to one of the claims 1 to 4, characterized in that the aggregate is of mono-granular type without any smalls in the upper partial layer

6. A layer according to one of the claims 1 to 4, characterized in that the aggregate is of mono-granular type without any smalls in the lower partial layer.

7. A carriageway comprising a draining bituminous upper layer blanket, characterized in that the upper layer blanket complies with any of the claims 1 to 6.

8. A method of realization of a draining bituminous upper layer blanket according to any of the claims 1 to 6, characterized in that the upper and lower partial layers are applied in a single pass by a road finishing machine.

9. A method of realization of a draining bituminous upper layer blanket according to any of the claims 1 to 6, characterized in that the upper and lower partial layers are applied in two successive passes by a road finishing machine.